The obtained results indicate that the increase of spent liquor content in the cooking solution does not lead to significant reduction of the physico-mechanical indicators of FIP as well as indicators of yield and residual lignin content, compared with the values obtained in the process of wheat straw cooking without the addition of liquors. Though this tendency is observed only with the addition of spent liquor at the level of up to 10%.

It should be noted that by analyzing the data above, one can conclude that the addition of spent liquor to the fresh cooking solution in the amount of up to 10% does not significantly impair the pulp quality, but contributes to its cost reduction, and especially leads to the reduction of harmful emissions into the nearby water reservoirs.

References:

1. By Куок Бао. Получение беленой целлюлозы из древесини осины в системе перуксусная кислота – изобутиловый спирт – вода: автореф. … канд. техн. наук:, "Санкт-Петербургская лесотехническая академия", Санкт-Петербург, 1995, с. 45.

2. Edel R. M., Brunow G. Reactions of β-aryl ether lignin model compounds under formic acid and peroxyformic acid pulping conditions // The Intern. Symp. on Wood and Pulping Chemistry. – Raleigh, -NC, -USA, May 22–25, 1989. Proceedings.

3. Barbash V., Trembus I., Alushkin S., Yashchenko O. Comparative pulping of sunflower stalks // Scientific Journal «ScienceRise». – 2016. - №3/2(20), P. 71-78.

ELECTROCHEMICAL MEMBRANE PROTECTION DURING DESALTING HIGH-MINERALIZED WATER

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Using marine and underground mine water, one of the main water treatment problems is mineral and biological deposits during demineralization by membrane technologies.

Each of the demineralization methods has both positive and negative quality indicators.

New developments offer comprehensive multi-stage water treatment schemes with the processing of concentrated brines. The most complex unit of the salt extraction technology is the reduction of the content of CO_3^{2-}, SO_4^{2-}, Cl^- ions from 25000 to 1000 mg / dm^3.

These processes are very laborious and energy intensive. In addition, such methods as electrodialysis, reverse osmosis, sodium cationization are economically feasible for mineralization of 1000-100 mg/dm^3 and lower.

Thus, the urgent task is to create a technology and apparatus for the primary demineralization of highly mineralized mine water with minimizing energy costs.

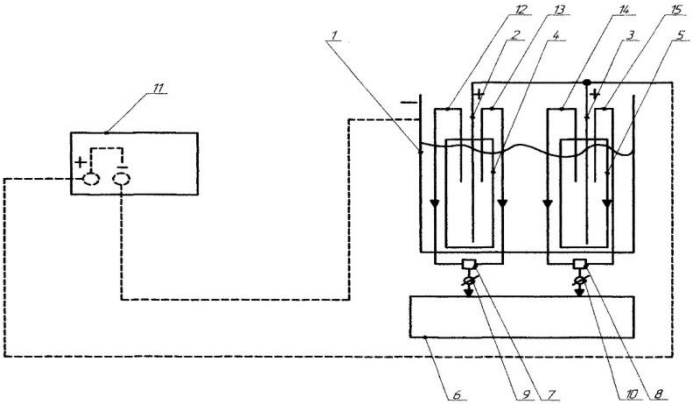
The aim of the work is to study the process of demineralization and disinfection by the method of electroactivation and to develop an apparatus for the comprehensive treatment of sea and mine water to prepare for the final demineralization of water by membrane methods.

Electrochemical activation is a physicochemical process, a combination of electrochemical and electrophysical effects on water in the space discharge zone on the surface of electrodes. At the cathode, due to an increase in the concentration of OH^- ions, a 70-80% current efficiency is achieved, for example, to reduce the hardness of water, iron cations, and other heavy metals.

The presence of a chlorine ion leads to the formation of a number of oxygen-containing chlorine ions by known mechanisms of electrode reactions in the anode region.Hypochlorite ion leads to effective disinfection of water. The decrease in the concentration of organic compounds is associated with the adsorption and coprecipitation of hydroxides on colloidal particles in the cathode region and with the partial oxidation of dissolved organic substances by a hypochlorite ion and coprecipitation on iron hydroxide in the anolyte, which simplifies the water treatment technology. It consists in separate separation of precipitation and further mixing of catholyte and anolyte.

Effectiveness research was carried out of the method of electroactivation, and also determined the dependence of the parameters of the electrochemical effects on the composition of marine and underground mine water.

We get a graphical dependence of the degree of groundwater treatment on various parameters (current strength, voltage, distance between electrodes, time of electroactivation, sampling of acidic water), their analysis and conclusions regarding the use of the electrochemical activation process to prepare water with a reduced probability. to the stage of membrane desalination.



1 - electroactivator body (cathode) 2, 3 - electrodes (anodes) 4,5 - canvas bags for electrodes; 6 - capacity for anolyte; 7, 8 - pumps; 9.10 - cranes for the selection of anolyte; 11 - power supply; 12, 13, 14, 15 - pipes for the selection of anolyte and catholyte.

Figure 1. Diagram of a laboratory installation for water purification by electroactivation.

Table 1. The results of demineralization of underground water mine Donetsk basin by electroactivation

Name of water quality indicator	Research results		
	Source water	After cleaning method electroactivation	Power purification%
Dry residue, mg/dm^3	9806	4665	52,4
Sulphates,mg/dm^3	450	270	40
Chlorides,мг/дм^3	2958	700	76,3
Total stiffness, мг/дм^3	43,8	20,5	53,2

The process of demineralization of sea water from the Tiligul estuary in the Odessa region was studied (Table 2). on a bench installation. This process is directly related to the water source for Odessa Port Plant, where membrane technologies are used in the water treatment scheme for production. The optimal conditions for electroactivation are established, changes in the chemical properties of sea water after electroactivation are determined, the feasibility of using this pre-treatment method for the stable operation of ultrafiltration and reverse osmosis systems over a long period of operation is proved.

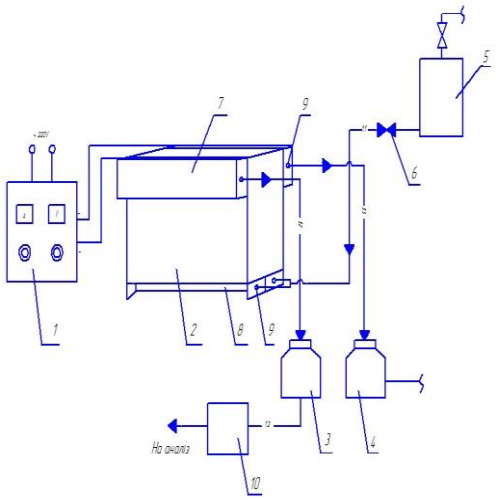
A continuous apparatus with electrodes of a special design (steel cathodes and ORTA-anodes) was developed for research.

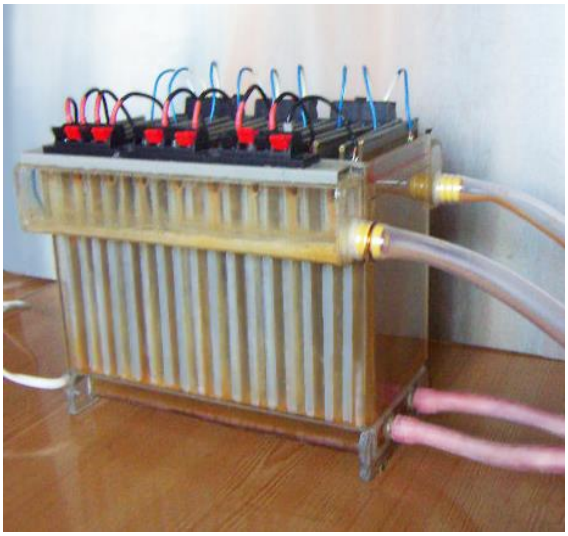
Table 2. The degree of water purification of the Telegul estuary (current density 1.0 - 1.5 A/dm^2, the amount of electricity in the experiments (in kWh /m^3): No. 1 - 5.5, No. 2 - 7.8.)

Indicators, mg/dm^3	% purification		
	Source	Experience 1	Experience 2
Salinity	7228.6	50,64	59,39
Hardness mEq/dm^3	77,31	67,21	74,15
Oxidation mgO_2/dm^3	14,0	78,40	80,10
Sulphates	1072,4	54,89	56,22
Chlorides	867	58,61	58,99
Bicarbonate	341	81,60	87,00
Ca^{2+}	370	69,50	70,45
Mg^{2+}	715	58,12	60,11

In the process of purifying sea water in one pass through the electroactivator, the content of heavy metals decreases by 85-96%; organic compounds decreases by 58-65%, microorganisms decreases by 89-94%. Electricity consumption amounted to 7-10 kW·h/m^3. Residual active chlorine after mixing catholyte and anolyte maintains membranes in a pure form without calcination and biological deposits for a long time.

The equipment and technology for rational use of the process for preliminary demineralization of water have been developed and proposed.





1 - power supply; 2 - main capacity; 3 - capacity for catholyte; 4 - capacity for anolyte; 5 - container with test water; 6 - tap 7 - a chamber for water drainage; 8 - a chamber for supplying water; 9 - fitting; 10 - anolyte sump.

Figure 2. Scheme of the bench setup for electrochemical activation

Figure 3. Photo of a flow-through bench electric activator.

Thus, the present work has confirmed that this method of purification is a universal method for the prevention of calcification (sulfate deposits), biofouling and demineralization, which can be effective for water purification technology using ultrafiltration and reverse osmosis.

References

1**.** Bahir V.M. Electrochemical activation: Inventions, technique, technology / V.M. Bahir - M.: Delfin Aqua, 2014.-512 p.– ISBN 978-5-9904688-3-2

2.Nelson L. Nemerow Environmental Engineering: Water, Wastewater, Soil and Groundwater Treatment and Remediation [Sixth Edition] [Edited] / by Nelson L. Nemerow, Franklin J. Agardy, Patrick Sullivan, and Joseph A. Salvato – John Wiley & Sons, Inc. Hoboken, New Jersey, 2009 by. – 384 p. – ISBN: 978-0-470-08303-1

3. Yakovlev S. V., Krasnoborodko I. G., Rogov V. M. Technology of electrochemical water treatment / S. V. Yakovlev, I. G. Krasnoborodko, V. M. Rogov - L. Stroyizdat. Lehning. Department, 1987 .-- 312 p., ill. - ISBN 5-274-00174-2